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No Teacher Left Unqualified: How Teachers and Principals Respond to the Highly Qualified Mandate

Abstract

In this paper, we examine the NCLB definition of a "highly qualified" teacher, the combined nature of federal and state highly qualified mandates, and how science teachers and their principals in one large, urban district have responded. In particular, we report on the kinds of licenses that teachers of science hold; the relationship between science teachers' qualifications and teaching assignments, both within and outside of their licensure; and the extent to which these trends vary across different student populations, subject disciplines, and over time. In addition, we present principal- and teacher-interview data from eight case-study schools and district-wide teacher-survey data to shed light on our findings and show how the NCLB definition of highly qualified is understood and regarded by teachers themselves. The data show that progress has been made in assigning teachers with demonstrated content knowledge in the specific science subjects they are assigned to teach, however the rate of change is slower for some students populations and science disciplines. Moreover, both teachers and principals adapt to these mandates in a variety of ways, some of which reflect the intended and unintended consequences of these policies.

Key words: educational policy, science education, science teachers, teacher qualifications, teacher certification, teacher placement

Introduction

Daviston Public Schools[1] is like many other school districts across the country. Administrators have worked hard to increase the number of highly qualified teachers in their districts in order to meet the mandate of the No Child Left Behind (NCLB) Act of 2001. During the 2007–2008 school year, 97% of the teachers teaching within the Daviston system were deemed highly qualified by the state according to the No Child Left Behind definition (Honawar, 2008). That is, they held bachelor's degrees, had licenses to teach in their state, and had demonstrated subject-matter competency by one of the NCLB measures. Within that group of highly qualified teachers, however, there was a range of expertise. Some were first-year teachers; others had been in the system for decades. Some held degrees in education; others had content-area concentrations. Some consistently took part in professional development; others avoided it at all costs. Some felt highly qualified to teach; some did not.

We looked carefully at the nature of science teachers' qualifications in the Daviston Public Schools as part of a larger study that examines the relationship between science teachers' engagement in professional development and their qualifications. In this paper we ask, what is the relationship between science teachers' qualifications and their teaching assignments? We report on the kinds of licenses that teachers of science hold, the extent to which they are assigned to teach courses within and outside of their licensures, the extent to which those instances vary across different student populations and subject disciplines, and how these trends have changed over time. In addition, we present principal- and teacher-interview data from eight case-study schools and district-wide teacher-survey data to shed light on our findings and show how the NCLB definition of highly qualified is understood and regarded by teachers themselves.

Examining the impact of NCLB through the lens of science provides a unique perspective that other subjects cannot offer. Although science learning has been viewed as critical to our nation's future, it has been overshadowed by attention to mathematics and literacy, rendering the impact of NCLB on science teachers largely unknown. Moreover, because science is composed of several disciplines, it creates the need for discipline-specific credentials, and thus NCLB's emphasis on—and definition of—"highly qualified" is rigorously put to the test.

What Is a Highly Qualified Teacher?

NCLB definition.

We know that teachers have a significant effect on student learning, and that content knowledge plays an important part in teachers' effectiveness (Darling-Hammond, 2000; Izumi & Evers, 2002). Thus, the NCLB act required that by the end of the 2005–06 school year, all classes in core academic subjects (English, reading or language arts, mathematics, science, foreign languages, civics and government, economics, arts, history, and geography) be taught by highly qualified teachers. While NCLB allows states to set their own requirements for meeting the highly qualified threshold, the legislation specifies that teachers at least meet the following criteria (U.S. Department of Education, 2003):

A. Have a bachelor's degree;
B. Be certified/licensed to teach in the state (or participate in an alternative route to certification); and
C. Demonstrate a high level of competency in their subject matter by:
   a. passing a state test in each subject in which they teach; or
   b. successfully completing an undergraduate major/coursework equivalent to an undergraduate major/a graduate degree/advanced certification or credentialing, in each subject they teach; or
   c. using an individual professional development plan (i.e., High Objective Uniform State Standard of Evaluation, or HOUSSE[2], plan)—an option available only to veteran teachers.

State definition: Provisions and loopholes.

The state in which Daviston Public Schools operates has met and, in recent years, exceeded the NCLB minimum requirements for licensure and for obtaining the "highly qualified" designation in two important ways. First, NCLB allows states to have science teachers demonstrate that they are highly qualified by holding a license in either a "broad field" (e.g., science) or in specific science disciplines (e.g., biology or physics) (U.S. Department of Education, 2003). Daviston's state has chosen the higher bar and requires teachers of core academic subjects to hold the appropriate valid license for the specific subjects they are teaching (e.g., a teacher who teaches both physics and chemistry must possess a valid license in both disciplines in order to obtain the "highly qualified" designation). Because the requirements for getting a teaching license in Daviston's state include having a bachelor's degree and passing the appropriate subject-matter test (thereby demonstrating subject-matter competency), the state meets all the requirements listed in the NCLB legislation. Second, Daviston's state requires that, in order to be considered highly qualified, special education (SPED) teachers or teachers of English language learners (ELL) who are the *lead* teachers of core academic subjects must hold a SPED or ELL license respectively in addition to a license in the core subject(s) they teach.

However, these more rigorous licensing requirements are accompanied by provisions that essentially act as loopholes, allowing some teachers who otherwise would have failed to meet the "highly qualified" requirements to do so through exceptions. For example, a "20% rule" allows teachers of core subject areas to teach outside of their licenses as long as it amounts to less than 20% of their schedules. Districts can apply this exception for up to three teachers in each subject area within a school. Grandfathering is another provision of NCLB that allows teachers of core academic subjects (with the exception of high-need areas) who have met prior—and arguably less stringent— requirements to retain their "highly qualified" status. For example, prior to the 2007–08 school year, teachers needed to hold a valid license, but not necessarily in the subject they were teaching. As a result, a teacher hired prior to 2007 with a biology license could teach physics and be considered "highly qualified" (e.g., if that teacher completed a HOUSSE plan before 2007); whereas that same teacher hired one year later and given the same teaching assignment would not. The grandfathering rule, in combination with the more stringent state legislation, has created the paradoxical situation in which teachers with the same qualifications, teaching the same course, could have different "highly qualified" designations.

While Daviston's state has exceeded the minimum licensing requirements of NCLB, it is not alone in the degree to which it has incorporated provisions into its regulations that relax their stringency, taken advantage of NCLB's broad requirements, or interpreted NCLB's requirements loosely. Darling-Hammond and Berry (2006), Berliner (2005), Center of Education Policy (2007), and Smith and Gorard (2007) criticize NCLB for providing vague definitions that allow states to apply lower "highly qualified" standards. Education Trust (2003) and Keller (2005) provide evidence of how differently states apply NCLB's requirements and provide unreliable data on the "highly qualified" designations of their teachers. Moreover, while no one would argue against the value of possessing strong subject-matter knowledge, many have criticized NCLB's emphasis on content knowledge in the designation of "highly qualified," to the exclusion of pedagogical skills, experience, and other qualities (Smith et al., 2007; Smith, Desimone, and Ueno, 2005; Darling-Hammond & Sykes, 2003; Berry, Hoke, & Hirsch, 2004). This concern is one that we will address later in this article; however, we begin and focus primarily on the nature of the science teaching credentials of Daviston's teachers of science, which serves as the backdrop for our study.

By teacher of science, we mean any teacher who has been assigned to teach a science course, whether or not they are certified in that science discipline or identified as a science teacher by the district. "Science teacher," on the other hand, typically refers to those who have the requisite background and credentials to teach science. This distinction between science teacher and teacher of science is relevant because of the importance of teaching assignment to this discussion. Because teachers can be assigned to teach more than one science discipline, their status as highly qualified depends in part on the license(s) they hold and in part on the courses their principals assign them to teach. As we will discuss later, teaching-assignment decisions are based on a number of factors, not just who on a school's faculty has the appropriate license.

Study definitions: Teaching within and outside of licensure.

Given the significant and different ways the designation "highly qualified" has been applied by federal and state policy, we sought a definition that focused on the intent of the legislation: the credentials of teachers of science and their subject-matter knowledge.

With this goal in mind and for the purposes of our study, we developed three categories to describe the match between teachers' qualifications and their teaching assignment(s). First, the group of teachers whose status meets the most stringent definition of "highly qualified" are those who are teaching subjects for which they have the relevant license. We refer to them as TWL (teaching within their licensure). Second, we refer to teachers who are teaching outside of their licensure, for example a person teaching a physics course who has a biology license, as TOL (teaching outside their licensure). Because some teachers teach more than one science discipline, they can be teaching both within and outside their licensure (i.e., they are both TWL and TOL). In addition, many teachers acquired new licenses during the course of our study, and so our third category refers to those teachers whose new licenses matched the science disciplines they were teaching. These teachers moved from TOL to TWL, and we refer to them as TLC (teaching licensure changed).

Using these categories of teachers' qualifications allows us to bypass the vagaries of the "highly qualified" designation cited above and concentrate on the intent of the state and federal regulations—to have every child taught by a teacher who knows his or her subject. At the same time, we acknowledge—and will discuss at the close of this article—the concern raised by many (see Smith et al., 2007; Darling-Hammond & Sykes, 2003, and Berry et al., 2004) that content knowledge is necessary but not sufficient to ensure effective teaching.

Methods

Study site.

Daviston Public Schools is a large, urban district located in the northeastern United States. In 2009, it had approximately 140 schools with approximately 30,000 middle and high school students. About 70% of the district's students are eligible for free or reduced-price meals, 37% are English language learners (ELL), and 20% require special education services (SPED). Over the three years of our study—2005–06 to 2007–08—the district employed a total of 693 teachers of science. The teaching conditions in Daviston are similar to other urban districts. Teachers and their principals reported in our interviews that they often have to contend with lack of resources, challenging students, and mounting responsibilities and pressures.

Data collection.

We used the district's employment, teaching credential, and teaching assignment data for middle and high school teachers of science to analyze trends in the match between teachers' qualifications and the subjects they were assigned to teach. In addition to the district-level data, we collected data from two separate samples: a set of interviews in eight case-study schools that were conducted in 2008, and a district-wide summative survey administered in 2009.

Our interviews were conducted with 47 teachers of science and their principals at the eight Daviston case-study schools. These included both middle and high schools[3] representing the range of student demographics in the district. We interviewed most teachers of science in the case-study schools. The teachers we interviewed ranged in experience from 1 to 34 years with a mean of 8.7; 9 taught unified science in middle school and 38 taught biology, chemistry, or physics in high school. The semi-structured teacher and principal interviews were conducted using a protocol designed by the research team, field tested and refined. Teachers were interviewed once during a single school year, and principals were interviewed once over the course of two years. Interviews lasted 30–60 minutes.

The summative survey was developed by Program Evaluation and Research Group (PERG) as part of the larger study, and distributed to 490 Daviston teachers of science with an overall response rate of 45%. The data we present was provided by 106 teachers of science who responded to a specific question on the survey: What do you think is missing from the public discussion about what teachers need in order to be considered "highly qualified"?

Data analysis.

Using the categories of teacher qualifications (TWL, TOL, and TLC), we examined the district employment data to determine the distribution of teachers teaching within and outside of their licensure, and how those numbers changed over time. We analyzed data by the science discipline taught, and by the type of students taught—either regular (REG), SPED, or ELL. We examined the number of course sections taught by TWL and TOL teachers, and the average number of sections they taught by discipline and by student population across the years. Interview and survey data was used to elaborate on our findings and to understand how the NCLB definition of highly qualified is understood and regarded by teachers themselves.

Findings

The match between teaching qualifications and teaching assignments.

Shifts in teaching assignments.

We analyzed three years of district data beginning with data from the school year 2005–2006, to identify trends in teaching assignment and teacher licensure, and found that the number of teachers teaching science was relatively stable across the years (M=441, SD=3.5). However, only 33% of the teachers taught science for all three school years, 24% taught science for two years, and 42% taught science for only one year. Of those who taught science for one year, 15% were teaching science in 2007–2008 for the first time. (Since this was the last year we investigated, we cannot determine if these teachers taught more than one year.)

These numbers indicate the high level of mobility within this district's teaching workforce, similar to what has been found in other studies (see Ingersoll, 2003b, and Morton, et al., 2008). Within this short span of time in Daviston, most of these teachers either stopped teaching science or left the school district entirely. Of those who continued to teach science in the district for more than one year, 29% experienced changes in their teaching assignments (either they were asked to teach an additional discipline, to drop a discipline they were already teaching, or both). As we know, this level of mobility has implications for a variety of issues, including student learning, professional development, and school culture (see Guin, 2004; National Commission on Teaching and America's Future [NCTAF], 2003; Claycomb, 2000).

A number of factors discussed in the literature explain these patterns of teacher departures and shifts in teaching assignments. Some researchers argue that the departures are a function of poor retention (Darling-Hammond & Sykes, 2003; Ingersoll, 2003a; Ingersoll, 2003b) while others argue that the aging workforce and retirement are the culprits (Baker & Smith, 1997). Some explain shifts in teaching assignments as a result of poor management (Ingersoll, 2003a; Ingersoll, 2003c; Johnson, 2006), while others maintain that it is a response to teacher shortages that arise because we cannot meet the demand (Darling-Hammond & Berry, 2006; Blank & Toye, 2007; Center of Education Policy, 2007).

We have seen evidence of all of these issues in our study. For example, interview data suggests that the state's licensing exam in physics is very difficult, and as a result, there is a shortage of licensed physics teachers in the district. This is borne out by the state's licensing exam data, which show that of the 268 first-time test takers of general science, physics, chemistry, biology, and earth science in 2009, only 10% took the physics test and, of those, the pass rate was just 37%. Only the earth science pass-rate was lower, at 30.4%, compared to 51.1% (chemistry); 60.4% (biology); and 79.3% (general science).

Unanticipated changes in student needs from one year to the next also explain shifts in teaching assignments. This can happen, for example, when a high number of students fail the state's required science test and additional sections have to be created in the subsequent year. Principals reported that changing student enrollments and budget cuts necessitated cutting positions and then moving the staff internally to accommodate these vacancies, and that these staffing decisions were often influenced by NCLB policies. One principal noted that due to the requirement that they only hire teachers who had passed the state's licensure exam, there are "teachers we can't hire back … even though we want to keep them."

Teaching within and outside of licensure.

To determine which teachers were teaching within and outside of their licensure, we examined the match between their teaching assignments and their credentials. The results are displayed in Table 1 and indicate that 60% (414) of teachers of science were teaching only outside their area of licensure throughout the three years of data. Only 22% (149) were teaching within their licensure, and 13% (87) taught courses both within and outside

Table 1. Trends in Teaching Within and Outside of Licensure from 2005–06 to 2007–08

	Only TOL (% of total)	Only TWL (% of total)	TOL & TWL (% of total)	TLC (% of total)	Total
Total number of unique teachers	414	149	87	43	693
Number of teachers in 2005–06	256 (58%)	95 (22%)	59 (13%)	31 (7%)	441
Number of teachers in 2006–07	229 (51%)	101 (23%)	72 (16%)	43 (10%)	445
Number of teachers in 2007–08	211 (48%)	118 (27%)	71 (16%)	38 (9%)	438
Change from 05–06 to 07–08	- 10%	5%	3%		

their licensure (approximately 18% of teachers of science in Daviston were assigned to teach more than one science discipline).

The number of highly qualified teachers recently reported by Daviston for NCLB purposes was over 90%, and there are several important reasons why the numbers we provide are lower. First, we report on science teachers only, whereas the district's report covers all subjects. Second, we apply a higher standard in which we only consider the match between a license in a science discipline and teaching assignment, and we ignore provisions that make it easier for teachers to be considered "highly qualified." Regardless of the reason, however, Daviston's incidence of out-of-field teaching is not uncommon, particularly in hard-to-staff schools (Ingersoll, 2004; Johnson, 2006) Table 1 also shows a desirable trend from year to year, as the proportion of TWL teachers within the cohort increased by 5%, and the number of TOL teachers decreased by 10%. In addition, the number of those who teach both within and outside their licensure increased by 3%. We also see that across the years, 43 teachers (6%) obtained new licenses in science disciplines they were teaching during those years. A less conservative way to look at the change in teacher-assignment status is to view the percent change using the 05-06 school year as a baseline. This would demonstrate an increase of 24% in TWL, and a decrease of 18% in TOL. From either perspective, these numbers do not represent changes in regulations, since we used the same criterion for evaluating teachers in all the years. Instead, these numbers represent real changes in the match between teachers' licensure and their teaching assignments.

Another positive trend that is not shown in Table 1 is the number of licenses that teachers acquired in subjects they were not assigned to teach during those three years. For example, 127 teachers (approximately 18% of all teachers of science) obtained such additional science licenses, 56 teachers added a license in other fields (e.g. history, 14 added administrative licenses and 45 added licenses in math and/or technology). Finally, 71 teachers acquired SPED licenses, and 12 acquired ELL licenses in order to better meet their students' needs.

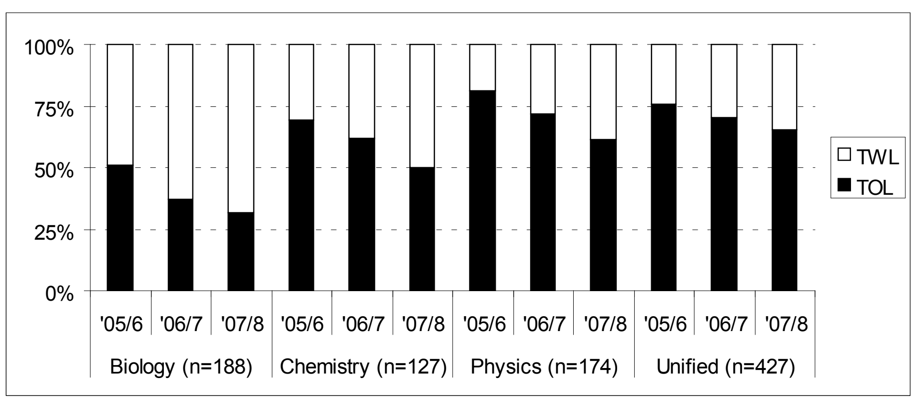
All told, 289 teachers of science (42%) obtained 449 new credentials during the three years of this study. The incidences of teachers increasing their credentials have implications for a broad array of issues and are influenced by a variety of factors. These are discussed in more detail in subsequent sections of this article.

Analysis by discipline.

In this section, we look at trends in TOL and TWL teachers across the science disciplines to determine the degree to which there may be meaningful differences in the match between teaching assignment and credential[4]. The results are presented in Figure 1, and the data shows a desirable shift from year to year, with the number of TWL teachers increasing and the number of TOL teachers decreasing in all disciplines. However, we see a dramatic difference across the disciplines in terms of the percentages of TWL and TOL[5]. In 07–08, the year in which each discipline had its greatest percentage of TWL teachers, we see that biology (at 65%) is the only discipline taught by more than 50% TWL teachers. The discrepancy is at its peak for the unified science courses, where only 32% of the teachers were TWL and over 65% were TOL.

Two factors help explain the large numbers of teachers assigned out of licensure. One factor relates to SPED and ELL requirements, which we discuss below. The second factor relates to the unified science course which is taught in the middle grades, and includes biology, physical science, and chemistry components. Although there is a state licensing test specifically for unified science[6], as our data show, most teachers did not possess that license. Many held no science license at all (275—many of whom held elementary or SPED licenses, or licenses in a variety of other subjects), others held a license in one science discipline (35), and a smaller number obtained a unified license sometime during the three years (15). Although an elementary license or a license in one science discipline may demonstrate content knowledge in some topics taught in the course, it does not demonstrate the total range of content that is covered and therefore, using our criterion, does not reach the standard of TWL. The problem of under-qualified teachers

Figure 1. Distribution of teachers in licensure groups within different science disciplines across the three school years



* Percents are from the total n in each discipline.

in the middle grades has also been identified and discussed elsewhere, particularly by Cooney and Bottoms (2003) and in the U.S. Department of Education [U.S. ED] report, *State and Local Implementation of the NCLB* (2007).

Analysis by student population group.

With regard to SPED and ELL teachers, it is important to recall that Daviston's state requires lead SPED and ELL teachers of science to hold at least two licenses, one in SPED or ELL respectively and the other in the science subject(s) they teach. Among the 47 ELL[7] teachers, the percentages of TOL and TWL teachers remained around 50% in both school years. Among the 152 SPED teachers there was a particularly high percentage who were in the TOL group (96%), with little improvement across the years. In comparison, among the 329 teachers of science who taught regular students (i.e., not ELL or SPED) in school year 06-07, approximately 50% were TOL and 50% were TWL. By school year 07-08, the percentage of TWL teachers increased to 60%.

The only viable option to demonstrate science-content knowledge for SPED or ELL teachers who did not have a science license is to obtain the relevant undergraduate major (or coursework equivalent), a graduate degree, or an advanced certification. Only nine (6%) out of the 147 SPED teachers who were TOL used this option.

Overall, the data shows that the number of TOL teachers is higher than desirable for all population groups, but that SPED and ELL students are far more likely to be taught by teachers who have not demonstrated content knowledge of the science subjects they are teaching than their peers who are taught by teachers without SPED or ELL license. This local trend mimics a similar national trend (U.S. ED, 2007; Katsiyannis, Zhang, & Conroy, 2003; Center on Education Policy, 2007).

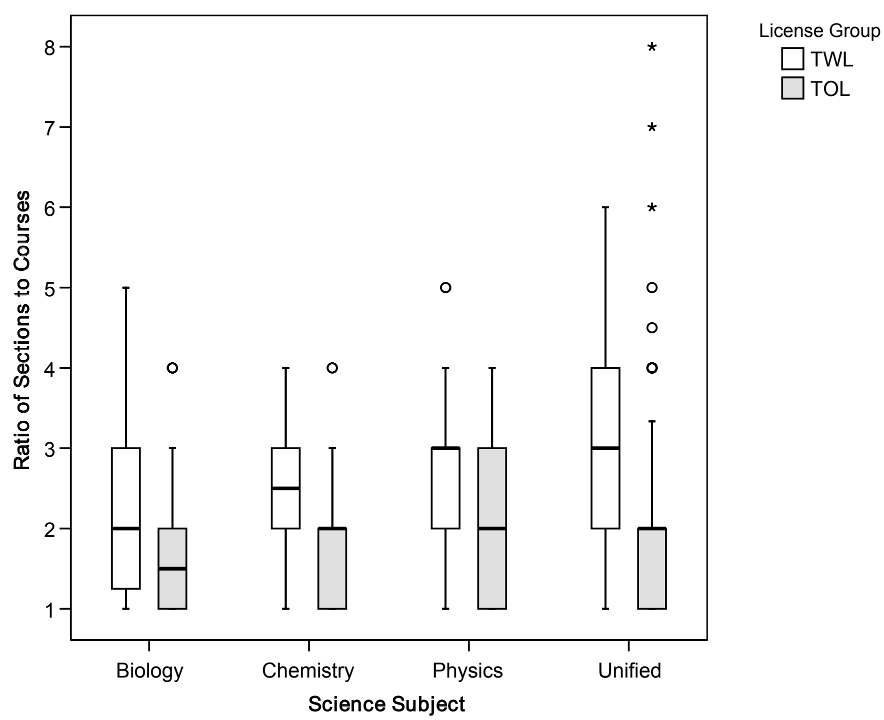
Analysis by teaching load.

To understand the scope of the TOL problem, we also looked at the data by the number of course sections taught. The more sections a teacher teaches the greater number of students he or she affects; a TWL teacher in chemistry who teaches four sections is making a much larger impact on the overall student population than a TOL teacher who teaches only one section. Figure 2 shows the distribution of the ratios of sections-to-courses taught by teachers in each license group across the different disciplines. The figure shows a desirable outcome—that the average number of sections taught by TWL teachers is larger than the average number taught by TOL teachers across all disciplines. In other words, teachers who hold a license in the subject(s) they are assigned to teach, teach more sections than those who do not have the relevant license. The flip side of this, of course, is that teachers with one or more licenses carry a heavier science teaching load, an issue of the costs and benefits of multiple licenses that we will discuss further in a subsequent section of this article.

A two-way ANOVA using status (TOL vs. TWL) as one factor and population type (Regular vs. SPED and ELL) as another factor resulted in significant effects for both the status factor, $F(1,628)=12.6$, $p<.01$, and the population factor, $F(1,628)=24.2$, $p<.01$, and their interaction, $F(1,628)=6.2$, $p<.05$. The significant differences in estimated marginal means show that regular education teachers teach more science sections than SPED or ELL teachers, TWL teachers teach more science sections than TOL teachers, and regular education teachers who are also TWL teach more than anyone else.

In conclusion, the district level data show that Daviston has made meaningful headway in increasing the number of courses and sections taught by teachers with the requisite licenses;

Figure 2. Box plots of the ratio of sections to courses by licensure groups within different science disciplines



however, those gains have been slower for physics and unified science, as well as for middle school, SPED, and ELL students. These data also tell an interesting story about the way administrators and teachers are reacting to the NCLB legislation and state regulations. To comply with these requirements, principals need to reduce the number of teachers who are TOL in core academic subjects and increase the numbers who are TWL. To do so, they have a variety of moves they can make with regard to their staffing decisions, and our data show that all of these decisions occurred in Daviston. For example, they can assign TOL teachers to non-core subjects or eliminate positions; they can hire new teachers who are TWL, assign the TWL teachers to teach more courses, or ask the TOL teachers to add the required license. Every year, principals have reduced the number of sections taught by TOL teachers, while assigning more sections to the TWL group, thus boosting the numbers of students taught by highly qualified teachers. At the same time, the district has increased its emphasis on recruiting and hiring teachers with the requisite licenses, while many already employed teachers have added licenses, and some of them added licenses that helped them switch from TOL to TWL status in the science they were teaching.

The data also indicate that in some science subjects, particularly physics and unified science, the gap was very hard to bridge. There were simply not enough teachers with the required licenses; and although their numbers are increasing, they are still the minority. Similarly, although the teachers of SPED students had the requisite SPED license, they lacked the license for the science subject they were assigned to teach. As a result, most SPED students were taught science by teachers that Daviston's state would define as under-qualified.

Perspectives from Daviston Teachers

What is missing from the NCLB highly qualified definition?

As a prelude to understanding teachers' decisions regarding their pursuit of one or more science licenses, we asked how teachers felt about NCLB's "highly qualified" designation, and whether they thought it was indeed an indicator of a teacher's effectiveness in the classroom. In this section, we report on the responses of the 34 teachers from the case-study schools who discussed this with us, and on the 106 teachers who responded to this question on the district-wide survey.

The majority of all the teachers indicated that the NCLB definition of a "highly qualified" teacher is lacking in one way or another. Of the 34 teachers we interviewed, 21 (62%) indicated this was the case, and 92 of the 106 survey respondents (87%) said the same. In fact, more than half of all teachers specifically stated, as the quotes below express, that they did not think the "highly qualified" status was linked to a teacher's effectiveness.

> *I feel like highly qualified doesn't mean much and they put a lot of emphasis on it and all it really means is that you have specific degrees and you passed a couple of tests, but it doesn't mean that you are a good teacher.*

Teachers acknowledged the importance of content expertise in their responses. However, in contrast with NCLB and the state, 10 of the teachers we interviewed (29%) and 80 of the survey respondents (75%) identified other aspects of teaching that were equally if not more important to effective teaching and being considered highly qualified. These included good pedagogical skills, exposure to professional development, and teaching experience.

> *I think that content knowledge is essential … and the truth is that can't be the only factor that we use to determine whether a teacher is qualified or not. You can know all the physics you want. If you can't control the classroom, you can't implement that lesson.*

> *Teachers need to understand how people learn [and have] the ability to assess critical-thinking skills [and] … teach critical-thinking skills.*

> *Test scores don't guarantee that a teacher has a good rapport with students. They should also like their students and show an interest and respect for their cultures.*

Other responses acknowledge the value of professional development, teaching experience, and the time it takes to develop the art and craft of teaching, as this quote demonstrates:

> *I clearly believe that what makes a person highly qualified is not so much what he does before becoming a teacher but what he does after he becomes a teacher, because qualification … comes with experience, [and] with professional development after you become a teacher.*

Costs and benefits of one or more science licenses.

Daviston's demand for science teachers is clear from the data. Although some subjects and students are better served by qualified teachers than others, the fact remains that there are still serious gaps. And while it is true that 23% of Daviston's teachers of science acquired an additional science license during the three years of data we reviewed, their change in status did not satisfy the demand and begs the question of why more teachers are not doing likewise.

To better understand the choices they made about pursuing (or not) one or more science licenses, we asked teachers about the pros and cons of doing so. Of the 47 teachers we interviewed, 15 had more than one license, 29 had only one license, 3 had no license at all, and 18 were working on adding a credential, either in science (11) and/or another area such as SPED or ELL (10). Four of those 18 teachers were working on adding both a science *and* a non-science license. Regardless of their licensure status, 34 teachers had opinions about the costs and benefits of having more than one. Not surprisingly, of those 24 who reported any cost, the major disincentive teachers identified was that it would result in their being assigned to teach classes they didn't wish to, or to teach fewer of the classes in which they were most interested. This was particularly true for physics where the need for teachers is especially acute, as is the case elsewhere in the country (Lu, Shen, & Poppink, 2007; Ingersoll & Perda, 2009).

> *I would love to teach bio more than physics; that is my passion. So the con would be that you are not teaching something that you really, really love, and what you went into teaching to do.*
>
> *When I got that [initial science certification], they said, 'Well, can we give you chemistry, can we give you health, can we give you biology?'*
>
> *If I were licensed in something else, they can easily move me, and if I don't want to teach it, I wouldn't have much to say.*

These quotes also suggest the pressure that administrators face to assign licensed teachers to the science courses their schools offer, and its impact on their faculty. Although they entered a profession with knowledge of and a passion for a specific science discipline, teachers' ability to control their teaching assignments is limited (Ingersoll, 2003a & 2003c; Johnson, 2006), and is often overshadowed by the demands NCLB places on school administrators and the district as a whole (Krei, 2000). This is particularly meaningful for novice teachers whose inexperience already challenges their ability to teach well.

Given their views regarding the shortcomings of the NCLB definition of highly qualified teachers, it may not be surprising that some teachers were reluctant to increase their credentials because they did not feel it would signal an improvement in the effectiveness of their teaching. As one teacher noted, a "license wouldn't change anything. It is just a title." Moreover, the licensing process requires a significant amount of time, effort, and financial resources. As this teacher reported:

> *There is a lot of talk about requiring teachers to be "highly qualified," but not a lot of talk about HOW they can get there. Many WANT to do so but are restricted due to cost and/or time. For example, it can be very difficult for teachers with families to not only afford graduate courses but find the time to take them.*

In light of the potential added burdens of multiple licenses, one teacher explained that, "If there [had] been an incentive, then I would have considered it, but without that incentive, why am I going to put pocket money out there?"

The costs of increasing their credentials notwithstanding, 31 teachers also had opinions about the benefits of doing so. Of those, the most frequently cited advantage, mentioned by 22 of them, was the flexibility it afforded them to move within their schools or across schools in Daviston, and the added career options they would have should they choose to leave the district. Additionally, teachers spoke of the value of increasing their content knowledge, and the variety of work they do. Four teachers spoke specifically about the value of earning certifications that would enable them to better meet the needs of their SPED and ELL students.

Conditions for SPED and ELL teachers.

The conditions for SPED and ELL teachers are unique for several reasons and deserve particular attention. First, the shortage of SPED teachers was acknowledged by NCLB in 2004, when the legislation was modified to provide them with additional flexibility in meeting "highly qualified" requirements. The American Association for Employment in Education recently confirmed this national shortage in its annual educator supply and demand study (2008). The results show that all of the sciences and all special education fields were reported to be in considerable shortage—the designation of highest need—for Daviston's region and many others across the country.

The high need for SPED and ELL teachers in Daviston adds a sense of urgency to the special, dual-license requirements that these lead teachers must now meet in order to satisfy Daviston's state regulations. Prior to NCLB, SPED and ELL teachers were not required to demonstrate subject-matter competency in addition to their SPED or ELL credential, and this recent condition has yet to take its full effect. In our interviews, for example, some SPED teachers continued to suspect that an additional license was not actually required. Moreover, even as a number of regular education teachers indicated their interest in acquiring a SPED or ELL license, SPED and ELL teachers did not express a similar need for a content-related credential.

Summary

Daviston has made progress in assigning teachers to teach the subjects for which they have demonstrated knowledge. The three-year trend shows a continued reduction in teachers' assignments out-of-licensure across all science disciplines. At the same time, all science disciplines are not starting from the same place—biology continues to have many more discipline-specific licensed teachers than any other science subject—nor are they progressing at the same rate. Over the past three years, middle school unified science has made much slower progress in increasing the number of teachers with that science credential than biology, chemistry, or physics.

Just as all science disciplines are not benefiting equally from the emphasis on teacher credentials, the situation has not improved similarly for all students. While regular education students are far more likely to be taught science by a teacher with demonstrated content knowledge of that discipline, SPED, ELL, and middle school students will probably be taught science by a teacher who doesn't have the proper credential. Due to the districts' lack of access to licensed teachers for whatever reasons—limited supply, uneven distribution, or unpredictable demands—these students are being left behind. And what of their teachers? Has NCLB created an environment that enables the growth and development of teachers in their chosen profession?

In Daviston's state, the licensing requirements have changed often in the past several years in order to move closer to a higher standard of excellence in what can be measured efficiently by a large-scale exam: subject-matter content knowledge. At the same time, although studies have found some evidence to support the value placed on subject-matter knowledge, the evidence is not as strong as one would predict, while other attributes, such as experience and good pedagogy, are more consistently and positively associated with student outcomes (Rice, 2003, as cited in Akiba, LeTendre, & Scribner, 2009; Darling-Hammond, 2000). Moreover, in the race to comply with changing district and state demands, principals are moving teachers from subject to subject one year to the next, trying to staff their classrooms with "highly qualified" teachers. As our data show, only one third of the teachers of science taught science for three years in a row, and among them were teachers who experienced shifts in their course assignments from year to year. With this lack of stability, how are teachers to gain the experience they need to become the expert teachers that students deserve?

Even so, Daviston's teachers of science are acquiring more licenses, both in the science subjects they are currently assigned to teach and in other subjects and areas of specialty, as well. Our data show that 42% of the teachers we examined obtained new credentials during the three years of this study, although we can't know at this time whether this rate of license acquisition is different from the past. If teachers are acquiring licenses at a faster rate, this may be evidence of the impact of NCLB; if this rate represents a slowdown, then we may be seeing the toll that these regulations are taking on the teacher workforce. Given that the TOLs are decreasing and TWLs are increasing, we can see that the gap is closing, but the pace is quite slow and the pressure on teachers and their administrators is only increasing.

Moreover, although teachers acknowledge the value of content knowledge for teaching effectively, they criticize their state's and NCLB's emphasis on content knowledge alone in the designation of "highly qualified" status. That criticism, along with the burdens placed on teachers with multiple credentials and the costs associated with acquiring them, might explain why more teachers don't seek additional licenses. We don't know if the high need for teachers of science and the additional teaching burdens they experience explain why so many enter and leave science teaching over the years, or if their transience drives the need that requires principals to overburden the teachers of science that remain. Needless to say, there is more to learn. We do know, however, that teachers face a frustrating situation. On the one hand, they are required to be highly qualified by showing strong content knowledge, which many teachers believe is necessary—although not sufficient—for effective teaching. Furthermore, the time, cost, and effort needed to demonstrate subject-matter competency can outweigh the associated benefits. On the other hand, due to the district's provisions, some teachers receive or retain the "highly qualified" status based on less stringent requirements. As a result, some excellent teachers who, due to time or other constraints, have yet to take the licensure test in the subject they are teaching are not considered "highly qualified," while less capable teachers may be considered as such because of the provisions mentioned above.

Discussion and Implications

The National Commission on Teaching and America's Future writes about the changing face of the teaching workforce. Teachers entering the profession now don't have the same career expectations that their predecessors did. They don't necessarily expect a life-long profession in the classroom, but rather see teaching as one of many positions they may hold across a varied career. This younger population of teachers may think differently about the investments that they are willing to make in their professional development, as will the districts that employ them. And teachers with more experience are facing a profession that is quite different than the one they entered years ago. The burdens are greater, and the expectations and demands are more wide-ranging and complex.

The work of teaching is complex. Being a good teacher requires a variety of skills and abilities that take time and effort to acquire – effective teachers are grown; they aren't born that way. Which begs the question of whether the simple, binary designation of highly qualified or not is adequate for the task at hand. By oversimplifying the measure of a teacher's qualifications and raising the stakes for those who do not comply, we may be creating the turbulence and high mobility we see in the teacher workforce. Moreover, by rewarding teachers for the achievement of their students as some recommend, we may ultimately demonstrate the insufficiency of the "highly qualified" label because, as our teachers noted, being qualified does not mean you can teach well.

Our findings show that there is a trend of TOL teachers becoming TWL, but the transition is quite slow and, for the most part, teachers are teaching subjects for which they have no license. While changes in teaching assignment can happen very quickly based on the particular needs of a school, changes in qualifications take much longer to accomplish and require a measure of personal investment and sacrifice. It is not entirely clear to the teachers we interviewed that adding a credential would benefit them in the long run. They may be asked to teach more subjects they don't like; teach fewer subjects they prefer; or even worse, face the real possibility that even though they obtained an additional license they may not be assigned to teach that subject in the upcoming years. In light of these dilemmas, a teacher might easily conclude that if they truly wish to become a better teacher, spending the time to study for a licensure exam may not be the best way. Spending more time in professional development or partnering with a veteran teacher may be just as—if not more—likely to help them improve their teaching practice while having no impact on their "highly qualified" status. Given the constraints of time and money, it is hard to argue with the logic of that approach.

Another way to value the importance of content knowledge could simply be to call for it by name. Having every child taught by a teacher with subject-matter expertise is not a trivial goal, as our data show, nor does it imply any other skills or expertise. Having a career ladder and reward system for teaching that recognizes the growth and development that effective teaching demands could only benefit the profession and the students it serves. Otherwise, we may be seeing the evidence that both students and teachers are being left behind by using an oversimplified measure of the complex practice of high-quality teaching.

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Notes

[1] Daviston is a pseudonym.

[2] The HOUSSE plan is a combination of proven experiences in teaching and professional development and accumulated knowledge in the subject area.

[3] One was a K-8 school where we focused only on teachers who taught grades 6-8.

[4] Disciplines with small numbers of teachers are not used in this analysis (Earth science, n=36; technology, n=15).

[5] A combined TWL & TOL group is not shown because a teacher can only be in one license group for each discipline they teach. The TLC group is not shown because the data are presented by year, and within a year a teacher can be only TOL or TWL.

[6] The state exam used to certify teachers for the unified science course is referred to as the general science test.

[7] Only **lead** ELL or SPED teachers were included because the regulation requiring "highly qualified" status only applies to SPED teachers who are the teachers of record. Data for SPED and ELL teachers were only available for the 2006-07 and 2007-08 school years.

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